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Spatial distribution pattern and biology of tuna live-bait fishes in Lakshadweep

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Abstract

This paper embodies the results of the aimed exploratory baitfish survey conducted in all the lagoons, reefs and par areas in Lakshadweep, utilizing the vessel facility of FORV *Sagar Sampada* during the pre-monsoon season of 1988. Potentially rich baitfish grounds were located around Cheriyapaniyam and Baliyapaniyam reef areas, which are hitherto unexplored and unexploited realms. Species diversity indices were high at Minicoy, Kavaratti, Suheli Par, Kadamat Cheriyapaniyam and Baliyapaniyam reef areas. Caesionids constituted the dominant group (40%) followed by apogonids (18%), pomacentrids (17%), dussumierids (sprats) (17%), emmelichthyds (1%) and others (7%). Catch rate (catch per haul) of baitfishes was maximum at Kavaratti (1164g) and it ranged between 850-950g at Suheli Par, Minicoy, Chetlat, Kadamat and Baliyapaniyam Reef; 500-750g at Perumul Par, Bangaram-Tinnakara-Parali group, Kalpeni, Agatti and Cheriyapaniyam Reef, and 100-310g at Bitra and Kiltan islands. Biological characteristics such as size distribution, fecundity-length relationship and food and feeding habit are presented. The results obtained were compared with those documented based on the survey conducted during the post-monsoon period of 1987, and the recurring fluctuation in their availability and abundance discussed from an ecological point of view.

The dependence of pole and line tuna fishery on the spatial and temporal availability and abundance of live fishes is well-known. Scarcity of live baits is often reported as a major limiting factor for the expansion of tuna fishery in the Lakshadweep. The first live bait survey conducted by CMFRI during October 1986 to March '87 period has indicated the availability and abundance of unexploited live bait resources in the deeper parts of the lagoons in the northern islands (Gopakumar *et al,* 1991). It is evident that the utilization of these resource would reduce the live bait scarcity in the islands. The two par areas *viz.* Cheriyapaniyam and Baliyapaniyam and the lagoon at Kiltan could not be covered during the previous survey (1986-87) due to the lack of transportation facilities. Moreover, a resurvey was felt necessary around all the islands for assessing the temporal fluctuation in the availability and abundance of different species of baitfishes. During January-February 1988, the Research Vessel FORV *Sagar Sampada* along with a bait-boat was utilized for conducting a detailed live bait survey in all the lagoons, reefs and par areas of the Lakshadweep.

Material and methods

The study is based on the survey conducted onboard FORV *Sagar Sampada* and pole and line fishing boat. The details of the gears used and the methodology of sampling and analysis are presented elsewhere (Gopakumar *et. al.* 1991).

Results

Distribution: Distribution of tuna live bait fishes was studied at 14 lagoons *viz.* Minicoy, Amini, Kadamat, Kalpeni, Chetlat, Kiltan, Bitra, Cheriyapaniyam and Baliyapaniyam. At Cheriyapaniyam Lagoon, extensive areas of concentration of blue sprats were located at the nearshore areas of the northeast and southwest regions; apogonids were chiefly distributed at the deeper areas of northwest and southwest areas. Caesionids were available almost throughout the middle areas of the lagoon. At Baliyapaniyam Lagoon, the blue sprat was chiefly distributed at the south, southwest and eastern nearshore regions. Apogonids and pomacentrids were concentrated at the northern and western parts of the lagoon (Fig.1). At Kiltan, availability of live baits was confined to a few colonies of pomacentrids which were distributed at the south and southwest areas of lagoon. No live bait was available at Amini. In the other lagoons the distribution of the different resident groups was similar to that recorded earlier. However, abundance of the migrant group of caesionids was recorded in most of the lagoons during the survey.

Catch composition : The total catch, catch per haul and percentage composition of the different live bait fishes collected during the survey from the different lagoons is presented in Table.1. The catch per haul ranged from 85 g at Kiltan to 1064 g at Kavaratti. Sprats constituted the major group at Suheli Par and Bitra; apogonids were dominant at Kadamat; pomacentrids formed the major group at Perumul Par, Kiltan and Baliyapaniyam, and caesionids dominated the catch in most of the lagoons *viz.* Minicoy, Kalpeni, Kavaratti, Agatti, Bangaram and Cheriyapaniyam.

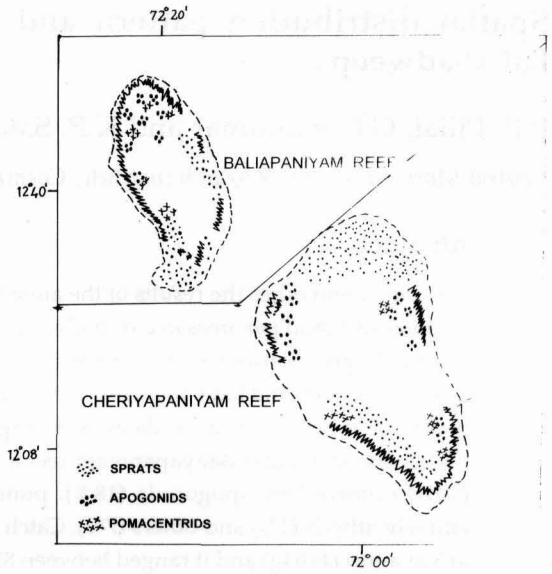

Fig.1. *Distribution of live bait fishes at (a) Baliyapaniyam Reef and (b) Cheriyapaniyam Reef.*

Species-wise occurrence of baitfishes in the different lagoons is given in Table.2. Caesionids formed the bulk of the catch (40%) followed by apogonids (18%), sprats (17%), pomacentrids (16%) and emmelichthyds (1%). Sprats were dominated by *Spratelloides delicatulus* followed by *S. gracilis. Pomacentrus pavo.* Caesionids were constituted by *Pterocaesio chrysozona*

Table.1. *Total catch (g), catch per haul (g) and percentage composition of tuna live-bait fishes*

Lagoons	Total catch (g)	Catch per haul (g)	Percentage composition					
			Sprats	Apogonids	Pomacentrids	Caesionids	Emmelichthyds	Miscellaneous
Minicoy	5570	795.7	10.8	3.6	2.5	83.1	--	--
Suheli Par	6640	948.6	33.1	9.8	28.3	19.9	8.9	--
Kalpeni	6150	615.0	22.8	13.3	8.1	55.8	--	--
Kavaratti	4255	1063.7	4.7	6.8	4.5	84.0	--	--
Agatti	3915	559.3	20.7	8.2	5.1	66.0	--	--
Bangaram	2710	677.5	6.6	22.9	8.9	39.5	--	22.1
Perumul Par	3470	694.0	2.9	14.4	49.8	32.9	--	--
Kadamat	5995	856.0	10.8	58.2	16.9	13.8	--	0.3
Kiltan	170	85.5	--	--	100.0	--	--	--
Chetlat	5630	938.0	1.8	13.0	13.5	9.9	--	61.8
Bitra	2200	314.0	77.3	18.1	2.3	2.3	--	--
Cheriyapaniyam	5100	510.0	6.3	11.2	18.5	63.9	0.1	--
Baliyapaniyam	4190	838.0	25.1	29.4	45.3	--	--	0.2

followed by *Caesio caerulaureus, P.tile,P. pisang* and *Gymnocaesio gymnopterus.* The dominant apogonid species was *Apogon leptacanthus* followed by *Ostorhynchus quadrifasciatus and Paramia quinquilineata.* Emmelichthydae was represented by *Dipterygonotus leucogrammicus.* The most common species during the survey were *Pterocaesio chrysozona, Caesio caerulaureus, Apogon leptacanthus, Ostorhynchus apogonides, Chromis caeruleus* and *Spratelloides delicatulus.* According to the nature of the distribution and abundance, different species recorded from the islands were : *P.chrysozona* at Minicoy, Kalpeni, Kavaratti, Agatti, Bangaram, and Cheriyapaniyam; *C. caerulaureus* at Minicoy, Kavaratti, Agatti, Bangaram, Perumul Par, Kadamat, Chetlat and Baliyapaniyam; *O.apogonides* at Kalpeni, Bangaram and Kadamat; *C. caeruleus* at Minicoy, Kavaratti, Agatti, and Perumul Par; and *S.delicatulus* at Minicoy, Suheli Par, Kalpeni, Agatti, Kadamat, Bitra and Baliyapaniyam.

The length-fecundity relationship of three species viz., *C.caeruleus, S.delicatulus* and *S. gracilis* were studied with the following results:

C.caeruleus

$\log F = -2.54158 + 2.6155333$

$\log L$ 'r' $= 0.673427$

S.delicatulus

$\log F = -5.44849 + 3.04919$

$\log L$ 'r' $= 0.8411538$

S.gracilis

$\log F = -7.215211 + 3.539061$

$\log L$ 'r' $= 0.808635$

Biology: The size composition of different species was as follows:

Species	Total Length range (mm)	Mode (mm)
Pterocaesio chrysozona	30-74	42
P. tile	30-98	80
P.pisang	44-57	46
Caesio caerulaureus	24-103	51
Chromis caeruleus	12-92	37
Spratelloides delicatulus	12-51	17
S.gracilis	28-60	48
Dipterygonotus leucogrammicus	30-64	52
Archamia fucata	45-75	47
Apogon sangiensis	26-59	37
A.leptacanthus	24-62	40
Rhabdamia gracilis	29-58	54
Ostorhynchus apogonides	23-56	39
Paramia quinquilineata	45-49	46

A non-linear relation indicated that fecundity increased in a proportion much greater than length.

Food amd feeding : The feeding condition and food of *S.delicatulus, S. gracilis, C.caeruleus, Pterocaesio tile, P.chrysozona* and *Caesio caerulaureus* were examined. Fishes with 'full' stomachs dominated in *S.delicatulus* and *C.caeruleus;* those with 'half full' stomachs in *C.caerulaureus, P.tile* and *P.chrysozona* and fishes with 'empty' stomachs in *S.gracilis.* All the species were zooplankton feeders. Copepods were the abundant group. Diatoms, decapods, mysids, isopods, cladocerans, chaetognaths, stomatopods, ostracods, amphipods, fish eggs and larvae, lamellibranches and gastropods were the other groups noted.

Discussion

The stability regarding the distribution and relative abundance of resident fishes in a coral reef habitat is an aspect of controversy. As stated by Sale (1980) a homogenous reef habitat will contain an assemblage of fishes drawn from a pool of species capable of occupying that habitat. The relative abundance of a species at a particular time will be subjected to large scale fluctuation depending mainly on the variable production and survival of larvae, change in patterns of force and direction of water currents and variability in precise microhabitat requirement of the different species.

In this context, a comparative analysis of the availability and abundance of live bait resources of the present survey with that of the survey conducted during 1986-87 has been made. In the first survey, pomacentrids formed the major group (41%) followed by apogonids (27%), sprats (24%), caesionids (6%) and artherinids (2%). The dominant species in different lagoons were *S.delicatulus, S.gracilis, R.gracilis, C. caerulaureus* and *Chromis caeruleus.* The island-wise abundance of the different species were: *S.delicatulus* at Agatti, Bangaram, Perumul Par, Suheli Par, Kadamat, Bitra, Kalpeni and Minicoy; *S.gracilis* at Agatti, Suheli Par, Bitra and Kalpeni; *A. fucata* at Kadamat and Minicoy; *R.gracilis* at Agatti, Perumul Par, Bitra, Kalpeni and Minicoy; *C.caeruleus* at Agatti, Bangaram, Perumul Par, Suheli Par, Kadamat, Bitra, Chetlat, Kalpeni and Minicoy and *Pranesus pinguis* at Bitra. The catch rates of live baits were

Table.2. *Species composition of tuna live-bait fishes (g)*

Species	Minicoy	Suheli Par	Kalpeni	Kavaratti	Agatti	Bangaram	Perumul Par	Kada mat	Kil tan	Chet lat	Bitra	Che riya pani yam	Bali ya pani yam	Total	%
DUSSUMIERIDAE															
S.delicatulus	600	1750	1400	200	800	180	100	650	–	100	1100	320	800	8000	14.3
S. gracilis	–	450	–	–	10	–	–	–	–	–	600	–	250	1310	2.3
POMACENTRIDAE															
C. caeruleus	60	1860	500	190	200	240	1720	1000	170	700	–	935	1900	9475	16.9
C. nigrurus	80	20	–	–	–	–	–	–	–	–	50	–	–	150	0.3
P. pavo	–	–	–	–	–	–	–	10	–	60	–	10	–	80	0.1
L. tapeinosoma	–	–	–	–	–	–	10	–	–	–	–	–	–	10	–
CAESIONIDAE															
C.caerulaureus	1320	280	150	1290	1770	480	900	460	–	550	50	380	–	7630	13.6
P.chrysozona	2120	310	3280	2175	800	590	230	370	–	10	–	2880	–	12765	22.8
P.pisang	365	–	–	10	10	–	–	–	–	–	–	–	–	385	0.7
P.tile	810	730	–	95	5	–	–	–	–	–	–	–	–	1640	2.9
G.gymnopterus	10	–	–	–	–	–	10	–	–	–	–	–	–	20	0.1
C.xanthonotus	5	–	–	5	–	–	–	–	–	–	–	–	–	10	–
APOGONIDAE															
A.sangiensis	–	450	–	–	–	–	–	–	–	–	150	–	30	630	1.1
A.leptacanthus	–	200	–	–	–	–	–	2550	–	700	–	150	1100	4700	8.4
A.fucata	–	–	–	–	–	–	–	–	–	–	–	20	20	70	0.1
R.gracilis	–	–	–	–	–	–	150	–	–	–	–	–	50	200	0.4
O.apogonides	200	–	820	270	320	620	350	855	–	20	250	400	–	4105	7.3
O.quadrifasciatus	–	–	–	20	–	–	–	20	–	–	–	–	–	40	0.1
P.quinquilineata	–	–	–	–	–	–	–	65	–	10	–	–	–	75	0.1
EMMELICHTHYDAE															
D.leucogrammicus	–	590	–	–	–	–	–	–	–	–	–	5	–	595	1.1
Others	–	–	–	–	–	600	–	15	–	3480	–	–	10	4105	7.3

maximum at Kadamat (1240g) followed by Bitra (810g), Agatti (800g), Suheli Par (790g) (Gopakumar *et al*, 1991).

The dominant live bait fishes collected during the two surveys were two species of sprats- *S.delicatulus* and *S.gracilis;* seven species of apogonids - *Archamia fucata, Rhabdamia gracilis, R.cypselurus,* and *O.apogonides;* seven species of caesionids - *Caesio caerulaureus, C.striatus, C.zanthonotus, Gymnocaesio gymnopterus, Pterocaesio pisang, P. tile* and *Pomacentrus pavo* and *Lepidozygus tapeinosoma;* the emmelichthyd *Dipterygonotus leucogrammicus* and the atherinid *Pranesus pinguis.* It could be seen that the species represented and their general distribution pattern in both the surveys were almost identical. However, their relative abundance in space and time showed variation during both the surveys. This agrees with the view of Bohnsack (1993) who opined that the pool of species which has been successfully recruited into a reef habitat over a period of time consititute the species composition of that habitat and no major change in the faunal elements could be noted over a long period of time, if there is no catastrophic environmental change. But due to the differential rates of mortality among the resident species and the chance colonization of the arriving recruits, the relative abundance of different species might show variation in space and time especially if the studies are made on short term basis. Hence it is evident that year to year fluctuation in the relative abundance of a live bait species is a regular phenomenon and is not a matter of concern. If long term studies with short sampling intervals are conducted, a clear picture would emerge on the species turn over of the livebait fishes of Lakshadweep.

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